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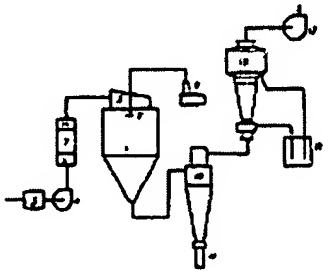
Claims 1 page; Description 3 pages, Drawings 1 page

[54] Title of invention: A method of spray drying heparin

[57] Abstract

A method of using a spray drying device to produce powdered heparin, characterized by the fact that an advanced spray drying process replaces the traditional production process of vacuum freeze-drying or vacuum bake oven drying. It great increases production efficiency and lowers production cost. It causes production to become continuous and reduces the intensity of effort required by workers.



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CLAIMS

1. A method of using a spray drying process to produce powdered heparin, characterized by a production method wherein a certain concentration of heparin solution that has undergone sterilizing filtration is sprayed through a sprayer to become small fog droplets, which, in a drying tower, come into contact with hot air that has undergone high-efficiency filtration, the solvent rapidly evaporating and a fine powder forming, the dry powder entering with the air a separation system, and the fine powder being recovered following separation.

2. The powdered heparin production method as described in claim 1, characterized by the fact that the heparin solution may undergo several forms of atomizing, such as pressure, centrifugal, and double-fluid nozzle, the drying process parameters thereof being adjustable based on the titer of the heparin itself.

3. The powdered heparin production method as described in claims 1 and 2, characterized by the fact that crude, low-titer heparin (generally titer $\leq$ 50 units/mg) has a concentration of 18%, with the drying process intake air temperature being adjustable from 200° to 250°C and the exit air temperature being adjustable from 85° to 100°C and that medium-titer heparin (titer between 50 and 130 units/mg) and refined, high-titer heparin (titer greater than 130 units/mg) have a concentration restricted within the range of 10% to 12%, with drying process requirements being: intake temperature 180° to 200°C and exit temperature restricted between 95° and 110°C.

4. The powdered heparin production method as described in claims 1 and 2, characterized by the fact that the air passes through three stages of filtration: primary, intermediate, and high-efficiency, the drying process being performed under positive pressure, generally restricted between 200 Pa and 800 Pa.

DESCRIPTION

A Method of Spray Drying Heparin

The present invention relates to the field of biochemical product preparation. Specifically, it is a method of producing powdered heparin.

It is already known that crude heparin separated and extracted from such internal livestock organs as swine intestines can be made into powdered heparin. The current methods of production are vacuum freeze-drying and vacuum bake oven drying. Vacuum freeze-drying production is expensive, has low drying efficiency, and involves non-continuous production. It also requires secondary processing, which tends to lower product quality. The drying efficiency of vacuum bake oven drying is even lower. As a result, materials are baked for a long period of time and product quality is even more vulnerable to adverse influences. It involves non-continuous production and in the end also requires secondary process, which tends to lower product quality. Therefore, we invented a spray drying method for production of powdered heparin. The new method eliminates the aforementioned negative factors.

The objective of the present invention is to provide a continuous, high-yield method of producing powdered heparin. Thanks to the high efficiency of spray drying, the materials and need only a short period of contact with hot air to form a powdered heparin production line involving large quantities of low-cost, low-labor powdered heparin.

The method of realizing the present invention is: Process a heparin solution using a spray drying device for single, continuous production of high-quality heparin powder products. The production flow is as shown in FIGS. I and II. Heparin solvent that has undergone high-efficiency sterilizing filtration is conveyed by a pump (9) to an atomizer (2), and the atomizer converts it into a large quantity of fine mist. Air is drawn in by a blower (4). It passes through a primary filter (5), an intermediate filter (6), an air-heater (7), and a high-efficiency filter (8). In the hot air distributor (3), it is evenly distributed into the drying tower (1), where it comes into rapid contact with the cloud of mist, evaporating the solvent and forming a dry powder. The dry powder is carried by the tail gas into the dry powder recovery system. In FIG. I, the majority of the dry powder is separated by a cyclone separator and then enters the receiving tank (11) for recovery. The output dry powder is recovered by the wet scrubber (13) and then input into the washing liquid tank (14). It returns to the previous section, where it continues to undergo sterilizing and filtration and is re-dried. The waste gas is drawn out by an induced draft fan and vented into the atmosphere. The first part of the flow path in FIG. II is the same as FIG. I, but in the recovery system the dry powder is recovered directly by a bag-type vacuum cleaner (10), and it enters a receiving tank (11) for collection. The waste gas is vented out by an induced draft fan (12).

The drying process parameters needed for realizing the present invention are as follows: refined heparin concentration 10% - 12%, intake air temperature 180° -

200°C, exit air temperature 100° - 110°C, positive pressure in tower 400 Pa – 800 Pa; intermediate heparin concentration 12%, intake air temperature 200°C, exit air temperature 95° - 105°C, positive pressure in tower 300 Pa – 600 Pa; crude heparin solution concentration 15% - 18%, intake air temperature 220° - 250°C, exit air temperature 85° - 100°C, positive pressure in tower 200 Pa – 400 Pa.

The advantages of the present invention: It achieves continuous production of powdered heparin using a simple technical process. It lowers production cost and reduces the work effort required of workers. Moreover, it results in superior-quality heparin powder products.

A comparison between the primary quality indices of the present invention and of the original drying methods practiced in China:

No.	Product Title	Drying Method	Titer (Test Results)
1	Crude heparin	Vacuum bake oven drying	45 units/mg
		Vacuum freeze-drying	48 units/mg
		Spray drying	47 units/mg
2	Intermediate-titer heparin	Vacuum bake oven drying	114 units/mg
		Vacuum freeze-drying	122 units/mg
		Spray drying	123 units/mg
3	High-titer, refined heparin	Vacuum bake oven drying	162 units/mg
		Vacuum freeze-drying	178 units/mg
		Spray drying	176 units/mg

*According to the 1995 China Pharmacopoeia, a 5% test error is permissible.

Embodiments of the Present Invention:

Embodiment 1:

Crude heparin solution spray drying: concentration 15%, intake air temperature 220°C, exit air temperature 95°C. Form of atomization: centrifugal. Recovery: primary cyclone separator plus primary wet vacuum cleaner. Main index: titer 46 units/mg.

Embodiment 2:

Crude heparin solution spray drying: concentration 10%, intake air temperature 220°C to 250°C, exit air temperature 100°C. Form of atomization: high-pressure. Recovery: primary bag-type vacuum cleaner. Main index: titer 42 units/mg.

Embodiment 3:

Crude heparin solution spray drying: concentration 12%, intake air temperature 180°C to 200°C, exit air temperature

100°C to 105°C. Form of atomization: centrifugal. Recovery: primary cyclone separator plus primary wet vacuum cleaner. Main index: titer 123 units/mg.

Embodiment 4:

Crude heparin solution spray drying: concentration 10.5%, intake air temperature 190°C to 200°C, exit air temperature 100°C to 110°C. Form of atomization: centrifugal. Recovery: primary cyclone separator plus primary wet vacuum cleaner. Main index: titer 175 units/mg.

Embodiment 5:

Crude heparin solution spray drying: concentration 5.6%, intake air temperature 180°C to 200°C, exit air temperature 90°C to 100°C. Form of atomization: Double-fluid. Recovery: primary cyclone separator. Main index: titer 128 units/mg.

DRAWINGS

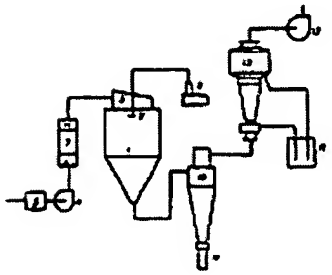

FIG. 1

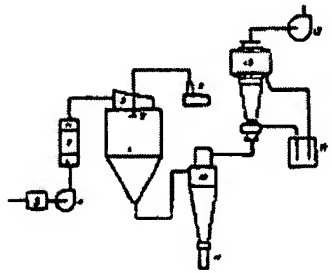

FIG. 2